Student Information

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Answer 1

a)

There are two groups with n people and m people.

- $n = 19$, $\overline{X} = 3.375$, and $s_X = 0.96$
- $m = 15$, $\overline{Y} = 2.050$, and $s_Y = 1.12$

The calculate degrees of freedom we can use formula 9.12 from the textbook page 263.

$$v = \frac{(\frac{s_X^2}{n} + \frac{s_Y^2}{m})^2}{\frac{s_X^4}{n^2(n-1)} + \frac{s_Y^4}{m^2(m-1)}} = 27.7$$

Then we can use the formula from the textbook page 263 since they are two sample spaces with with unknown and unequal standard deviations.

$$\overline{X} - \overline{Y} \pm t_{\alpha/2} \cdot \sqrt{\frac{s_X^2}{n} + \frac{s_Y^2}{m}}$$

To compute 95% confidence interval we can select $t_{0.025} = 2.048$ with 28 as degrees of freedom using the appendix A5 from the textbook.

$$3.375 - 2.050 \pm 2.048 \cdot \sqrt{\frac{0.9216}{19} + \frac{1.2544}{15}}$$

$$1.325 \pm 0.744447 \text{ or } [0.580553, 2.069447]$$

b)

Again using the same formula to compute 90% confidence interval we can select $t_{0.05} = 1.701$ with 28 as degrees of freedom using the appendix A5 from the textbook.

$$3.375 - 2.050 \pm 1.701 \cdot \sqrt{\frac{0.9216}{19} + \frac{1.2544}{15}}$$

$$1.325 \pm 0.61831275 \text{ or } [0.70668725, 1.94331275]$$

c)

If we calculate confidence interval for the group with people above age 40, using the formula 9.9 from the page 259,

$$\overline{X} \pm t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$$

We can choose $t_{0.025} = 2.101$ with 18 degrees of freedom to compute 95% confidence level.

$$3.375 \pm 2.101 \cdot \frac{0.96}{\sqrt{19}}$$

$$3.375 \pm 0.46272235858 \text{ or } [2.91227, 3.83772235]$$

Since 3 is in the interval the answer is NO.

Answer 2

a)

$$H_0 : \mu = 20.00$$

b)

$$H_A : \mu \neq 20.00$$

c)

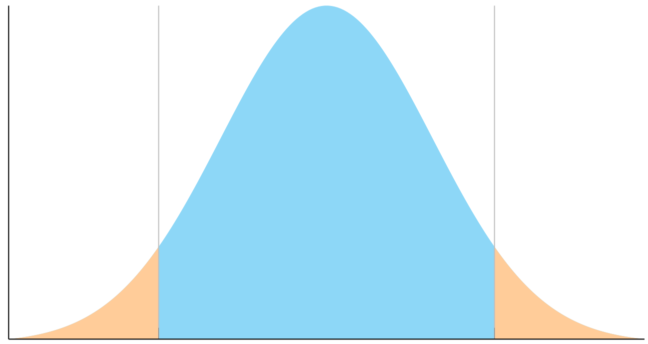
We can use the formula from the textbook page 276.

$$t = \frac{\overline{X} - \mu_0}{s/\sqrt{n}} \text{ with degrees of freedom } n - 1$$

$$t = \frac{20.07 - 20}{0.07/\sqrt{11}} = 3.31662479 \text{ with degrees of freedom } 10$$

Thus we can select $t_{0.005} = 3.169$ with degrees of freedom 10 for the statistical significance 1%. Since it is a two-sided test, we have to accept if $|t| < t_{\alpha/2}$.

$3.3166 > 3.169$, thus we have to reject it. They should stop producing and check the production line.



The orange areas represent the rejection regions

Answer 3

a)

$$H_0 : \mu_X - \mu_Y = 0$$

b)

$$H_A : \mu_X - \mu_Y < 0$$

c)

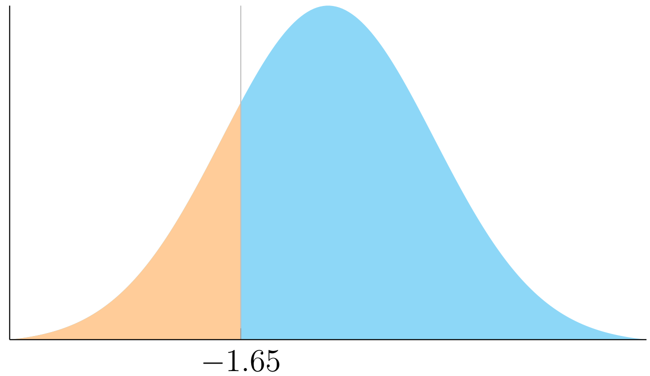
We can use the formula from the textbook page 273.

$$Z = \frac{\overline{X} - \overline{Y} - D}{\sqrt{\frac{\sigma_X^2}{n} + \frac{\sigma_Y^2}{m}}} \text{ where } D = 0$$

$$Z = \frac{2.8 - 3}{\sqrt{\frac{2.89 + 1.96}{68}}} = -0.74888$$

With 5% level of significance, we can select $z_{0.05} = 1.645$ from the textbook page 250. Since it is a left-tail alternative, we must accept it if $Z > -z_{0.05}$.

Since $-0.74888 > -1.645$, it is accepted. We can not state that the new painkiller really produce better results.



The orange area represents the rejection region